U.S. RADIUM CORPORATION,
RADIUM CRYSTALLIZATION LABORATORY
428 Alden Street
Orange
Essex County
New Jersey

HAER No. NJ-121-B

HAER
NJ
7-ORA,
33-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN BUILDINGS SURVEY
National Park Service
Northeast Region
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, P.A. 19106

HISTORIC AMERICAN ENGINEERING RECORD

HAER NJ 7-ORA, 33-

U.S. RADIUM CORPORATION,
RADIUM CRYSTALLIZATION LABORATORY

HAER NO. NJ-121-B

Location: 428 Alden Street
Orange
Essex County, New Jersey

USGS Orange, New Jersey Quadrangle,
Universal Transverse Mercator Coordinates:
18.565059.4515451

Dates of Construction: 1917

Engineer/Architect: Unknown

Present Use: Vacant

Present Owner: City of Orange, New Jersey

Significance: The U.S. Radium Corporation site, including the structural components of the radium crystallization laboratory, dating to the period 1917-1926, were associated with nationally significant developments in health and safety standards, the ability of woman reformers to secure protection for workers handling radioactive materials, and tools used to detect and measure radio-isotopes. Beginning in 1920, radium dial painters at the plant began reporting health problems later associated with radium exposure and many died over the next decade. There were no publicly recognized health or safety problems identified or standards established for handling radioactive materials at this time. The dead woman, and others who survived, became the first known victims of industrial radium poisoning. The survivors subsequent efforts to seek redress, in alliance with the Consumer's League, played a major role in the establishment of legislative protection for workers against industrial diseases. Equally important, scientific investigation of these dial painters, and of other victims of radium poisoning, led to the establishment of health standards used to protect workers in radioactive environments and to the emergence of human radiobiology as a field of study. These investigations had military as well as civilian implications. Even before official standards of workplace radiation exposure were established after World War II, data from dial painters' cases were a major source in the health and safety codes developed for the wartime Manhattan Project. The radium crystallization laboratory is a contributory element to the historical significance of the U.S. Radium site.

Project Information: The site is a Federal Superfund site and will undergo clean-up to remove radiological contamination. A previously conducted cultural resources investigation (Grossman and Associates 1997) determined that the site was significant and eligible for listing on the National Register of Historic Places. The former radium crystallization laboratory is one of two remaining structures on the site associated with its period of significance (1917-1926) and will be demolished as result of clean-up activities. To mitigate the adverse effect, the New Jersey State Historic Preservation Office stipulated documentation of the structures. Due to human health concerns arising from elevated levels of radiological contamination within the buildings, USEPA determined that restricted access to the radium crystallization laboratory's interior area was advisable and preferred. Therefore, only limited interior photographic documentation, in addition to exterior photographic documentation, was conducted to fulfill the New Jersey Historic Preservation Office's stipulation. At the direction of the USEPA, the historical narrative for this documentation was redacted from the 1997 Grossman and Associates report.

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PART I - HISTORICAL NARRATIVE

RADIUM CRYSTALLIZATION LABORATORY AND THE U.S. RADIUM CORPORATION SITE - NARRATIVE DESCRIPTION

This narrative history provides information on the radium crystallization laboratory (no. 428 Alden Street), part of the 2.2 acre U.S. Radium Corporation site, located in Orange, Essex County, New Jersey. Activities occurring at the site between 1917 and 1926, including those transpiring within the radium crystallization laboratory, and the subsequent consequences of those activities, are significant events in the history of worker health and safety issues in the U.S.

The radium crystallization laboratory is part of a HAER complex (the U.S. Radium Corporation site - see HAER No. NJ-121). The complex also includes the paint application building (see HAER No. NJ-121-A).

The U.S. Radium Corporation site is bounded on the east by High Street, on the north by Alden Street, on the south by the former alignment of the Erie Railroad's Orange Branch -- from which tracks have been removed -- and Wigwam Brook which currently flows in a concrete channel, and on the west by private residences. The radium crystallization laboratory, set back 80 feet from Alden Street to the north, is located towards the center of the site.

Between 1917 and 1926 (referred to here as the U.S. Radium Period), the primary activity at the site by the U.S. Radium Corporation (known until 1921 as the Radium Luminous Materials Corporation) was the extraction and purification of radium from carnotite ore to produce luminous paints and other radium products for military, commercial, and medical purposes. During the facilitys' operation, radium was extracted from carnotite ore containing two to four percent uranium oxide. A large amount of process wastes and tailings containing radioactive elements were temporarily discarded on unused areas of the main facility, and much of it was ultimately disposed of off site. Some was used apparently to fill portions of the site, causing most of the radiological contamination on the property, and some buildings were constructed directly over the waste material. At the time of operation, the facility consisted of ten buildings. Only two of these structures remain as of May, 1999. One is the former radium crystallization labortory and the other is the former paint application building (422 Alden Street). They were used commercially until the early 1980's and are now vacant. Portions of the buildings are radiologically contaminated as a result of the U.S. Radium Period activities that occurred within them.

The radium crystallization laboratory is a plain, concrete-block structure with simple rectangular plans, low gable roofs, and tile-capped parapets. The one-story former radium crystallization laboratory, located 80 feet south of Alden Street, is separated from the two-story former paint

application building (the other surviving U.S. Radium Period structure) to the east by only about three feet. Both structures were built in 1917 in the northwest section of Orange, New Jersey, in a neighborhood of late 19th century worker housing, commercial buildings, and hat factories. Much of this neighborhood remains intact with many modifications, including the row of two-story homes on the north side of Alden Street opposite the property. The lot immediately west of the laboratory has been razed. East of the paint application building, on a lot formerly part of the facility and used for radium extraction and refining, are four small one-story concrete block structures built since 1939 for a gas station, automobile body shop, and a number of small commercial operations. The rear of the facility was formerly open and used for storage and shipping purposes.

Between 1926 and the late 1930's, U.S. Radium demolished most of its Orange facility, leaving the two surviving structures, a boiler house, and several small ancillary buildings. The boiler house and ancillary buildings were subsequently removed from the site.

The radium crystallization laboratory is substantially intact structurally and retains its original form and location but has been altered by later additions, removal of all original equipment and most original fixtures, removal of some original interior partitions and exterior walls, and replacement or blocking of windows, skylights, or doors.

RADIUM CRYSTALLIZATION LABORATORY

Surviving U.S. Radium Corporation records (ANL n.d.a; n.d.b) include a number of undated equipment lists and floor plan sketches, both of which are relevant to this phase of plant operations. The radium crystallization laboratory was where purified radium bromide salts were refined as part of the luminous paint production process. Differences between the actual dimensions of this building and data on the floor plans suggest the drawings were alternative (unbuilt) versions of that structure. In addition to a masonry partition wall shown on insurance maps (Sanborn 1939, 1951) and partly visible today, there were probably a number of lighter-weight interior walls in the laboratory defining instrument, furnace, dark room, and other processing spaces. Virtually all of the equipment indicated on the available lists as having been used in the laboratory consisted of small table top items such as glass vials and tubing, and a few slightly larger items such as small generators, a 100-gallon still, and a small furnace. None of these items would appear to require heavy foundations or bases. Some accounts of facility operations suggests the luminous paint was made in this building, which also included another, separate laboratory for Dr. Sabin von Sochocky, founder, principal scientist and chief chemist of the Radium Luminous Materials Corporation, U.S. Radium's corporate predecessor (see below; Wall 1969; ANL n.d.c).

A smaller, squatter version of the paint application building, the 43-foot wide structure that

originally housed the radium crystallization laboratory consists of two sections. The northern 52-foot section has a structural system similar to that of the paint application plant, with bearing walls about 12 feet high, a low pitched roof, and a flat tile-topped parapet at each end. The southern 13 feet is a concrete block shed-roofed section which once housed von Sochocky's laboratory space. Original openings on the north side are not documented in available materials. Present openings, which appear to have been later additions, include pedestrian doors on the north and west sides plus a north-facing 12-foot wide roll-up garage door. Double or triple configured double-hung windows, of the same size used in the paint application building, lit the south, east, and west walls. All windows have been removed or blocked off. Two one-story concrete block additions, built ca.1944-50 and ca.1951-77, added another 68 feet to the rear of the original building.

Part of an original concrete-block partition separates the southern section from the rest of the structure. All original materials in this section have removed, along with much of the partition wall. In the remainder of the building, two 12.6-foot high, 10 by 4.75-inch I-beam columns support a north-south 12 by 5.5-inch I-beam and 10 by 4-inch I-beam roof joists at 6-foot centers. Two skylights, each 5.5 by 5.3 feet, penetrate the wooden roof along this central axis. Other than a 5 by 10.5-foot toilet enclosure, there are no signs of pre-1926 manufacturing activity. A small wooden office enclosure south of the toilet appears to be a post-1936 addition.

Among recognized structural and architectural forms of early 20th century industrial facilities, the radium crystallization laboratory building is somewhat unusual in its resolute absence of style and a structural system usually seen in inexpensive, auxiliary buildings. The use of concrete block could reflect a wartime shortage of steel, because more steel was usually used in reinforced-concrete structures. It is possible that the Radium Luminous Materials Corporation decided to expand so much and so fast in response to wartime contracts that the most quickly-built design was chosen. Brick bearing walls would have served as well structurally, but would have taken more time to erect. The structure would reflect this decision better with original window and door arrangements. With the modifications and additions, the radium crystallization laboratory now appears nearly indistinguishable from the later unrelated concrete block structures which cover portions of the former U.S. Radium site.

NARRATIVE STATEMENT OF SIGNIFICANCE

Radium Crystallization Laboratory

The radium crystallization laboratory of the U.S. Radium Corporation contains former work areas associated with nationally significant developments in health and safety standards, the ability of women reformers to secure protection for workers handling radioactive materials, and

tools used to detect and measure radioisotopes. Despite its compromised condition, the simple forms of the structure retain original dimensions and construction materials. The structure conveys the relatively spartan conditions in which radium bromide salts were crystallized for use with luminous paints and where that paint was possibly produced. The radium poisoning suffered by the dial painters who used the paint, and their attempts to seek redress in alliance with the Consumers' League, began chains of events pertaining to issues of worker health and safety which make the property historically significant today.

The condition, proximity, and association of the radium crystallization laboratory with the final stages in radium processing make the structure historically significant. Although impacted by later industrial uses, most of the building retains its U.S. Radium Period integrity. Accordingly, the structure represents a contributory element of the U.S. Radium site's National Register eligibility because, as one of two principal surviving elements of the period of the property's historic significance (1917-1926), it adds historical associations to the complex.

PART II - SOURCES OF INFORMATION

ORIGINAL DRAWINGS

U.S. Radium Corporation operations are poorly documented in available drawings. The only drawings contemporary with plant operations indicated are a few sketches of one or more equipment arrangements in an unidentified structure which is probably not the paint application building (ANL n.d.b:Microfilm 7). The most detailed plan of spatial and functional facility arrangements appears in a sketch plan with notes created during a 1979 interview with an unidentified plant superintendent who worked during the early 1920's (Siebert 1979).

Another contemporary drawing of the Orange plant is a site plan prepared for inclusion in the 1926 "Factory For Sale" notice of the U.S. Radium Corporation (ANL n.d.d).

HISTORIC VIEWS

A small number of photographs taken during or shortly after U.S. Radium Corporation operations at the Orange, New Jersey plant survive in archives of the Argonne National Laboratory. The five which were xerographically reproduced for inclusion in this work show the portions of the interior and exterior of the paint application building. Available finding aids for this archive do not specifically locate these views, which were obtained by Grossman and Associates 1997 during an earlier phase of this documentation. Another historic view of the front of the plant was included as part of the 1926 "Factory For Sale" notice of the U.S. Radium Corporation (ANL n.d.d).

For further information on historic views of the U.S. Radium site, as well as on other site related data, contact Dr. Carol Giometti, BioSciences Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, Telephone #: (630) 252-2000.

INTERVIEWS

Dr. Joel Grossman of Grossman and Associates (121 Essex Street, New York, New York 10002), Principal Investigator for the 1997 study from which this Historical Narrative is drawn, interviewed by telephone and correspondence Dr. R.E. Rowland, Environmental Research Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, Telephone #: (630) 252-2000. Dr. Rowland, former director of the Center for Human Radiobiology at Argonne National Laboratory, is an expert on the effects or radium in humans and on the history of radium studies in the United States.

Dr. Joel Grossman interviewed and, for a time, worked with Dr. Claudia Clark on his 1997 study. Dr. Clark is an assistant professor at Central Michigan University. She completed her dissertation on the U.S. Radium Corporation (at Rutgers University) and is an expert on the industrial processes that were conducted there and on the health history of its workers.

Dr. Joel Grossman interviewed Mr. Edward Lander of the United States Geological Survey, Reston, Virginia. Mr. Lander is an expert on radium industry processes.

Dr. Claudia Clark (see Clark 1993, 1997) interviewed Dr. William Castle (Harvard Researcher investigating health conditions at the U.S. Radium plant - see Castle, Drinker, and Drinker 1925) and Florence Wall (Laboratory Assistant, U.S. Radium Corporation, Orange Facility), and others.

Patricia A. Siebert of Argonne National Laboratory conducted interviews with individuals who worked at the U.S. Radium Corporation, Orange plant during the period 1920-1925 (see Siebert 1979). Information from that interview was included in the 1997 Grossman and Associates report.

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n.d.b Microfilmed Copies of Business Records. **Argonne National Laboratory Archives, U.S. Radium Collection**

n.d.c "Health Hazards of Radium Dial Painting. Report of an Investigation of 242 Employees on 7 Watch and Manufacturing Concerns." In **Box 122, Argonne National Laboratory Archives, U.S. Radium Collection.**

n.d.d "1926 Factory For Sale Notice for the U.S. Radium Corporation, Orange Facility." **Argonne National Laboratory Archives, U.S. Radium Collection.**

Castle, William B., Katherine Drinker, and Cecil Drinker

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1997 **Radium Girls; Woman and Industrial Health Reform, 1910-1935.** The University of North Carolina Press, Chapel Hill, North Carolina.

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1980 "Investigation of a Former Radium Processing Site." Bureau of Radiation Protection, New Jersey Department of Environmental Protection, Trenton, New Jersey.

Essex County, New Jersey
1917 **Liber** E58, p. 570, Essex County Hall of Records, Newark, New Jersey.

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1997 **Archaeological and Historical Sensitivity Evaluation of the U.S. Radium Facility - Final Report Tasks 1, 2, 3, 4, and 9 (Subcontract No. ARCS-C-018). Contract No. 68-W9-0051. U.S. Radium Corporation, City of Orange, Essex County, New Jersey, Work Assignment No. 004-2L67.** Dr. Joel W. Grossman, Principal Investigator. Report prepared for the United States Environmental Protection Agency. Report on file at the New Jersey State Office of Historic Preservation, Trenton, New Jersey.

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1999 **U.S. Radium Corporation Site - Photographs, Written Historical and Descriptive Data**. Submitted to Historic American Engineering Record, National Register Programs Division, Northeast Area Office, National Park Service, Philadelphia, Pa.

HAER No. NJ-121-A
1999 **Paint Application Building, U.S. Radium Corporation Site - Photographs, Written Historical and Descriptive Data**. Submitted to Historic American Engineering Record, National Register Programs Division, Northeast Area Office, National Park Service, Philadelphia, Pa.

Rowland, R.E.
1994 **Radium in Humans: A Review of U.S. Studies**. Argonne National Laboratory, Argonne, Illinois.

Sanborn Map Company
1939 **Insurance Maps of Essex County, New Jersey; City of Orange**. Sanborn Insurance Company, New York., N.Y. Map in the Collections of the New York City Public Library.

1951 **Insurance Maps of Essex County, New Jersey; City of Orange**. Sanborn Insurance Company, New.York, N.Y. Map in the Collections of the New York City Public Library.

Siebert, Patricia A.
1979 "Intra-Laboratory Memos to CHR Record Room, Argonne National Laboratory, September 26th and October 5th, 1979." In **Box 117:7, Argonne National Laboratory Archives, U.S. Radium Collection**.

U.S.G.S. (United States Geological Survey)
1981 **Orange, New Jersey, 7.5 Minute Quadrangle Map**. United State Geological Survey, Reston, VA.

Wall, Florence E.
1969 "Early Days of Radioactivity in Industry, Part I." **Chemistry** 42:4:17-19.

SOURCES NOT YET INVESTIGATED

Dr. Claudia Clark's 1997 work on the radium dial painters was published after the Grossman and Associates (1997) study was completed. Clark's work is an exhaustive study on the history of radium dial painters in New Jersey, Illinois and elsewhere and their role in industrial heath reform. It also contains a comprehensive bibliography on radium/dial painter related issues and locational information for relevant primary sources. Another excellent bibliography is included in Rowland (1994).

Additional documentary data identified but not included in the Grossman and Associates (1997) report, which may contain information on the paint application building or other U.S. Radium Period structures, are housed at the following repostories:

Center for Human Radiobiology, Argonne National Laboratory, Argonne, Illinois (contact: Christopher A. Reilly, Director, Environmental Research Division) -

- Robley Evans Papers
- Commissioner Harris (New York City Health Department) Correspondence Files
- Swen Kjaer (Department of Labor investigator) Papers
- Medical Files
- New Jersey Department of Public Health Files on Everett Field
- Radium Archives
- U.S. Radium Corporation Records.

Harvard Medical School, Harvard University, Boston, Ma. -
Francis A. Countway Library of Medicine, Reference Desk, Historical Section (contact: Mr. Dick Wolf)
Archives of the Francis A. Countway Libray of Medicine - Industrial Hygiene Department Records, Physiology Department Records and Frederick Shattuck Papers.

University of Medicine and Dentistry of New Jersey, Newark, New Jersey -
Special Collections and Archives, University Libraries (contact: Ms. Barbara Irwin and Ms. Lois Densky-Wolff)
Harrison Martland Papers.

Newark Public Library, Newark, New Jersey -
Radiation and Radium Clipping File.

New Jersey Historical Society, Newark, New Jersey -
Women's Club of Orange Records.

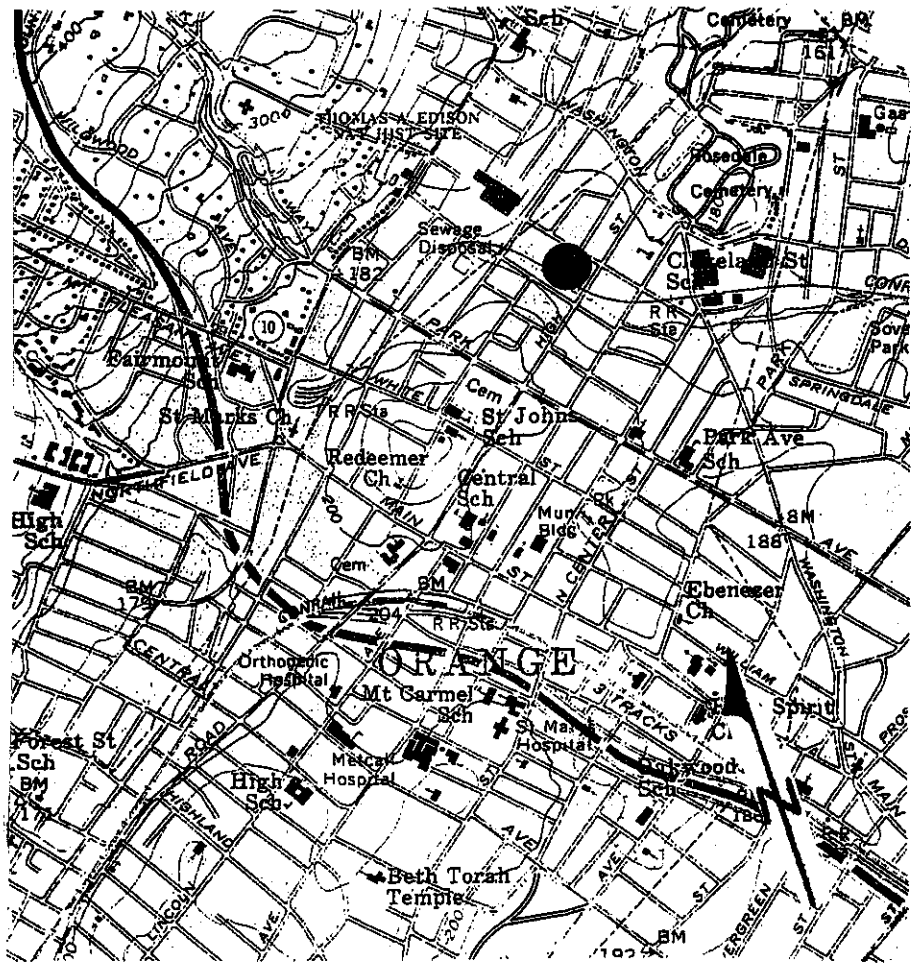
Rutgers University Libraries, New Brunswick, New Jersey -
Special Collections and University Archives
Consumers' League of New Jersey Papers
League of Womaen Voters of New Jersey Papers.

Other repositories not investigated by Grossman and Associates (1997) possibly containing architectural/engineering information on the paint application building and other U.S. Radium Period structures:

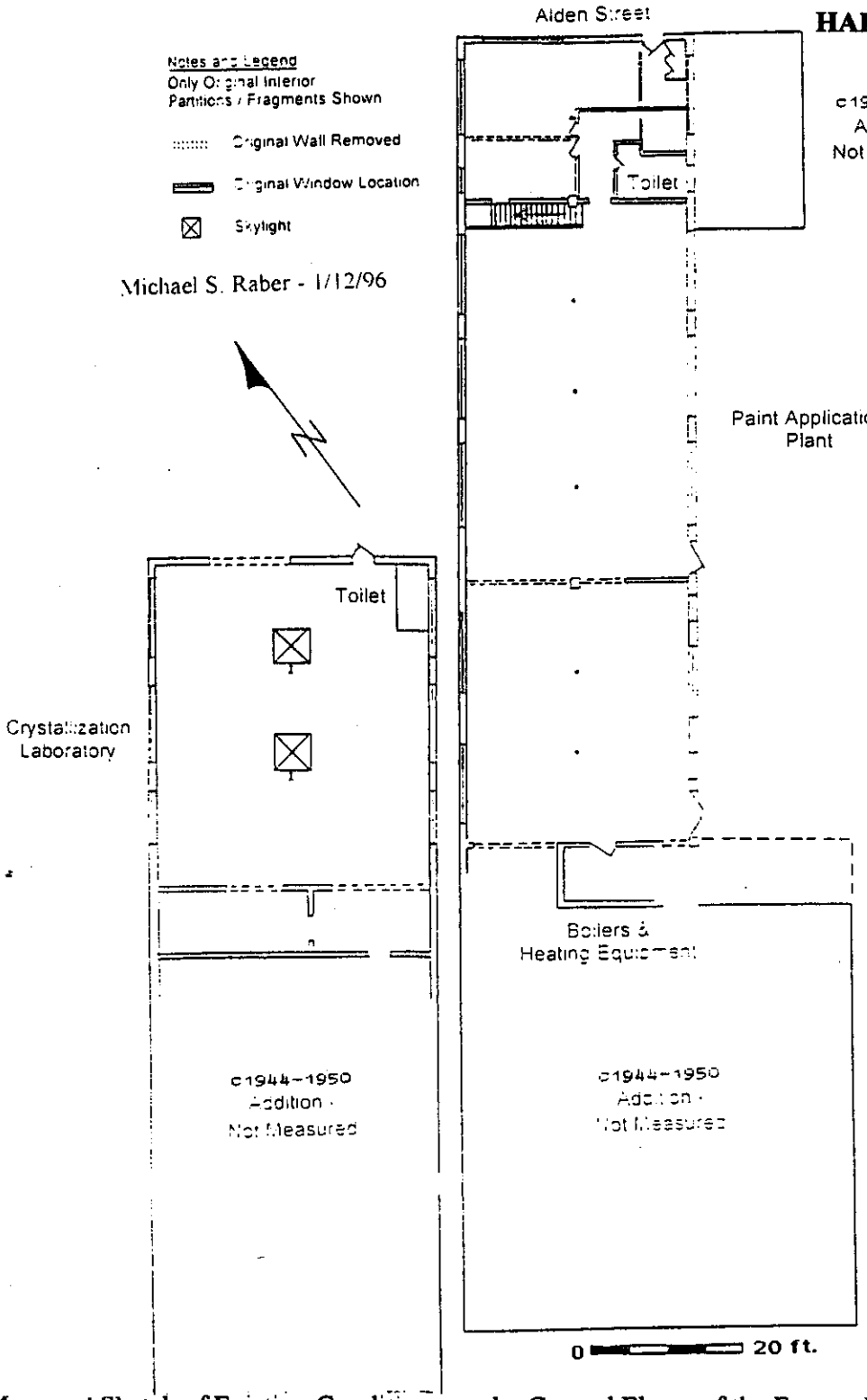
City of Orange, New Jersey,
Department of Building Inspection and Code Enforcement
Tax and Water Department
Tax Collector.

Other repositories of U.S. Radium related data identified by Clark (1997) but not reviewed for the 1997 Grossman and Associates study:
Schlesinger Library, Harvard University, Cambridge, Ma. -
Alice Hamilton Papers
Hamilton Family Papers.

The New York Public Library, New York, New York -
Astor, Lenox, and Tilden Foundations, Rare Books and Manuscripts Division
Florence Kelley Papers.



U.S. Radium Corporation Site
Base Map Source: United States Geological Survey 1981
Scale of Original: 1:24,000



Measured Sketch of Existing Conditions on the Ground Floors of the Former Paint Application Building and Radium Crystallization Laboratory